

(2.) That a compound exists in certain urines which under the influence of a fermentation yields cystin.

(3.) That the fermentation is due to the growth of an organism, which can apparently be separated from the urine by ordinary filtration, and must therefore be a *large organism, possibly a torula*.

(4.) That the cases recorded in which cystin has been found deposited in the kidneys and liver indicate that the *fermentation may begin in the system*.

III. "Some Stages in the Development of the Brain of *Clupea harengus*." By ERNEST W. L. HOLT, Marine Laboratory, St. Andrews. Communicated by Professor McINTOSH, F.R.S. Received February 11, 1890.

(Abstract.)

The stages described are (i) newly-hatched or early larval; (ii) early post-larval; (iii) $\frac{1}{2}$ -inch long; (iv) $\frac{3}{4}$ -inch long.

The development of the pineal region is treated separately, and in this a fifth stage— $1\frac{1}{2}$ -inch long—is introduced.

In the early larval stage the downward flexure of the fore part of the brain is very noticeable. It appears due to the general conformation of head at this stage. The cerebral lobes are short; the anterior commissure is well marked. The white matter of the cerebrum is divided into two patches on each side, from the most ventral of which the short stout olfactory nerves pass to the bases of the nasal sacs, now closely opposed to the cerebrum. The roof of the cerebrum is very thin, passing into the thicker roof of the thalamencephalon. The tips of the optic thalami are wholly vesicular. A diverticulum of the 3rd ventricle extends downwards and backwards, its distal extremity underlying the optic commissure. The broad ventral commissure of the infundibulum, noticed in *Anarrhicas*,* is well marked. A commissure shuts off the lumen of the infundibulum from the hind part of the 3rd ventricle immediately in front of the splitting off of the infundibulum. The optic ventricles do not appear in the front part of the mid-brain, and are only partially developed further back. The tori semicirculares are present in the hind part of the mid-brain as mounds on either side of the central fissure of the cerebral mass. The valvula appears in transverse section as a pair of ridges externally to the tori, before it shuts off the aqueduct of Sylvius. The cerebellar fold is very short; the pituitary body is a roundish mass of deeply staining cells, opposed ventrally to the membranous roof of the mouth, and clasped in front and at the sides

* McIntosh and Prince; 'Edinb. Roy. Soc. Trans.,' vol: 35.

by the walls of the infundibulum. These break down above the body, except for a fine cellular membrane. Behind the body is seen the tapering, downwardly-bent anterior end of the notochord.

In the early post-larval stage* "an apparent rectification of the cranial axis" has taken place, by the upward rotation of the cerebrum on its posterior end, doubtless owing to the rapid development of the oral and trabecular cartilages, and consequent forward rotation of the mouth. The same causes have also operated so as to withdraw the diverticulum of the 3rd ventricle from its position below the optic commissure. Changes are noticed in the arrangement of the nervous tissues. The olfactory nerves are longer, and the nasal sacs further from the brain. The fibrous bridge over the 3rd ventricle (behind the pineal body), terminating with the posterior commissure, is well marked. The tips of the tectum lobi optici are seen above it. The bases of the optic thalami (walls of the thalamencephalon) have increased in breadth. The mid-brain is comparatively large, and the optic ventricles much more advanced. The cerebellar fold rapidly thins out in the middle, assuming the form, in transverse section, of thick lateral elements united by a cellular band. The infundibulum has undergone vertical flattening. The future lobi inferiores are indicated as lateral expansions, behind which the 3rd oculomotor nerves pass outwards from the centre of the ventral surface of the cerebral mass. The infundibulum extends some way back above the notochord as a thin-walled sac. Its walls are little plicated compared with those in some other forms, *e.g.*, *Rhombus*,† *Anarrhicas*.‡

In the $\frac{1}{2}$ -inch stage the olfactory lobes appear as bulbous masses projecting from the front end of the cerebrum. Fibres can be traced from the optic nerves up to the fore part of the optic lobes. A pale median septum appears between the anterior extremities of the lateral optic ventricles, its base resting on the fibrous tract over the hind part of the 3rd ventricle. The tip of the valvula now appears in transverse section before its connexion with the cerebral mass can be made out, having thus grown forward. The cerebellum has greatly increased in size: instead of terminating as before on the surface of the brain, it is now continued into a thick fold bent sharply down on the anterior portion; its posterior end passes at once into the thin roof of the 4th ventricle. Two fibrous bands cross over the aqueduct of Sylvius in the substance of the cerebellum; their lateral extremities are fused. The lobi inferiores are better marked than in earlier stages. Longitudinal bands of fibres pass back from the roots of the oculomotor nerves through the medulla oblongata. Groups of large ganglionic cells appear on either side of these bands,

* Balfour, 'Development of Elasmobranch Fishes.'

† Stieda, 'Zeitschr. Wiss. Zool.,' 1869.

‡ McIntosh and Prince, *op. cit.*

and are connected by a fine commissure passing through both bands. At the origin of the VIII auditory nerves, this commissure is replaced by a St. Andrew's cross of fibres, the dorsal limbs of the cross passing to the nerve roots, and the ventral to the ganglionic areas.

In the $\frac{3}{4}$ -inch stage the olfactory lobes are more elongated. The olfactory nerves pass outwards from their anterior extremities. The septum behind the pineal body is larger, and contains a few very large cells. The septum, after losing its ventral connexion with the fibrous tract over the 3rd ventricle, persists for some way back as a cellular leaf-like appendage of the thin median roof of the optic ventricle; a few fibres pass back into this appendage.

The optic nerves are longer, from the outward displacement of the eyes. They are very stout and solid, and from their roots fibres may be very easily traced into the optic lobes. Fibres are seen passing from the cerebral mass across the optic ventricle, external to the tori, to the tectum lobi optici.

The flattening of the brain, noticed by McIntosh and Prince in the herring of $\frac{7}{32}$ inch, is intensified at this stage, and the brain is also much elongated.

Large ganglionic cells appear in the tori semicirculares about the region of the splitting off of the infundibulum. The white matter of the tectum lobi optici is very conspicuous, and shows traces of three cellular layers in its substance. A circular pale area appears amongst the vesicular matter on either side of the valvula. The lobi posteriores are present. Behind them the walls of the medulla approach each other dorsally, shutting off the central canal from the 4th ventricle. The walls recede again further back before finally closing opposite the last trace of the auditory capsule.

From behind the region of the auditory nerves a ganglionic area on either side persists backwards through the medulla oblongata. The cerebellum has increased in bulk; its anterior dorsal angle is carried forward. The fibrous bands previously noticed are carried further back, and now lie clear of the optic lobes. Three smaller fibrous bands occur behind them. In the herring of $1\frac{1}{2}$ inch the two first fibrous bands are fused together.

Pineal Region.

The roof of the thalamencephalon in the early stages is a single layer of large columnar cells passing forward from the front wall of the pineal stalk. It passes into the roof of the cerebrum, the cells diminishing greatly in size. The superior commissure of Osborn is present from the early post-larval stage; it is also present in the larval and post-larval *Zoarces viviparus*, where it is distinctly double. The first signs of the infrapineal recess of Hoffmann are seen in the

$\frac{1}{2}$ -inch stage. It is thus much later in developing than in *Salmo*;* and the fold forming its front wall never extends backwards to the same degree as in that form and in *Anarrhicas*. This fold, in the post-larval *Zoarces*, is thickened in its apex, and lodges a fine commissure. As pointed out by Balfour in Elasmobranchs the fold is due to the upward rotation of the cerebrum.

The fibrous tract over the 3rd ventricle in the herring is well marked in the $\frac{3}{4}$ -inch stage. It is seen to consist of fibres passing upwards and inwards from the optic thalami to the middle line above the 3rd ventricle, and then running forward to the stalk of the pineal body. The tract has a double nature, as is readily seen in vertical longitudinal sections of a herring $1\frac{1}{12}$ inch long. It is seen here to be a backwardly directed fold of the brain roof, continuous ventrally with the back wall of the pineal stalk, and dorsally with the roof of the optic ventricle, the apex of the fold being the posterior commissure. Its length in this form is due to the flattening of the brain, the tract being very short in *Zoarces*, where the brain is not flattened. In *Zoarces*, also, from the same cause, the limbs of the fold are less closely applied to each other and much thicker.

The pineal body is roundish and solid in the early larval stage in the herring. It is vertically flattened in the early post-larval stage. In the $\frac{1}{2}$ -inch stage it is much larger and contains a lumen; it shows signs of constriction into proximal and distal elements, and the lumen contains a coagulable, albuminous fluid, as in *Petromyzon*.† In the $1\frac{1}{12}$ -inch stage the constriction is still visible, and the walls are generally crenated. The tissues of the pineal wall are now divided into three layers, and are of varying thickness. The cartilage of the tegumen cranii overlies the body at this stage. The constriction of the body appears to be an exaggeration of the crenation of the pineal wall met with in *Salmo*; it has not, probably, the morphological value of the constriction of the body in *Petromyzon*.

IV. "A Cyanogen Reaction of Proteids." By J. GNEZDA, M.D.
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the Physiological Laboratory, University College, London.)
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When dry urea is heated to its melting point it gives off ammonia, and a substance called biuret ($C_2N_3H_5O_2$) remains behind. Biuret is decomposed by heat into ammonia and cyanuric acid ($C_3N_3H_3O_3$).

* Hoffmann, "Zur Ontogenie der Knochenfische," 'Arch. Mikrosk. Anat.,' vol. 23, 1884.

† Beard, "Parietal Eye in Cyclostomatous Fishes," 'Quart. Journ. Micros. Sci.,' 1889.